Amendments to the Claims

The listing of claims will replace all prior versions, and listings of claims in the application.

1. (currently amended) A lithographic apparatus, comprising:

an illumination system that supplies a beam of radiation;

a patterning system that imparts the beam with a pattern in its cross-section;

a projection system that projects the patterned beam onto a target portion of a surface of a substrate~~, the target portion having predetermined spatial characteristics relative to the substrate support that are appropriate for a desired exposure pattern on the surface of the substrate supported in a predetermined position on the substrate support~~;

a temperature measuring system that measures a respective temperature of a plurality of regions of the substrate;

a calculating system that calculates a dimensional response of the substrate to the respective measured temperature; and

an adjusting system that adjusts ~~the~~ spatial characteristics of the patterned beam~~target portion relative to the substrate support~~ to compensate for the calculated dimensional response.

2. (currently amended) The apparatus according to claim 1, wherein the temperature measuring system comprises:

at least one sensor that measures the temperature of the substrate at each of [[a]]the plurality of regions distributed across the surface of the substrate.

3. (currently amended) The apparatus according to claim 1, wherein the temperature measuring system comprises:

sensors distributed across a~~the~~ substrate support.

4. (original) The apparatus according to claim 3, wherein each of the sensors senses the temperature of an adjacent region of the substrate.

5. (original) The apparatus according to claim 3, wherein each of the sensors senses the temperature of an adjacent region of the substrate support.

6. (currently amended) The apparatus according to claim 1, wherein the temperature measuring system comprises:

sensors distributed on a sensor support positioned above a~~the~~ substrate support; and

a scanning system that is arranged to displace the substrate support relative to the sensors and to measure the temperature of regions of the substrate adjacent each of the sensors at each of a plurality of relative positions between the substrate support and the support.

7. (original) The apparatus according to claim 6, wherein the sensors are supported on a stationary frame beneath which the sensor support is displaceable.

8. (original) The apparatus according to claim 6, wherein the sensors are supported in a linear array extending transversely relative to a direction in which the substrate support is displaceable.

9. (currently amended) The apparatus according to claim 1, wherein:

the temperature measuring system comprises a substrate temperature mapping system that develops a map representative of the temperature at a plurality of regions of the substrate,

the calculating system comprises a system that develops a model of the dimensional response of the substrate in a substrate support coordinate system, and

the spatial characteristic adjusting system comprises a system that develops a map of a change in position of points on the substrate relative to the substrate support coordinate system given the mapped temperature at the plurality of regions of the substrate and the dimensional response model and a system for adjusting spatial characteristics of the patterned beam ~~target portion~~ in accordance with the change in position map to compensate for the calculated dimensional response.

10. (currently amended) The apparatus according to claim 1, wherein the adjusting system comprises:

an image correction system that adjusts a cross-sectional shape of the beam ~~to adjust a shape of the target portion~~.

11. (currently amended) The apparatus according to claim 1, wherein the adjusting system comprises:

a beam alignment adjustment system that adjusts the position of the patterned beam~~target portion~~ relative to the substrate support.

12. (currently amended) The apparatus according to claim 1, wherein the adjusting system comprises:

a beam magnification adjustment system that adjusts a size of the patterned beam~~target portion~~.

13. (currently amended) A device manufacturing method, comprising:

emitting a beam of radiation using an illumination system;

imparting to the beam a pattern in its cross section;

projecting the patterned beam of radiation onto a target portion of a surface of a substrate~~, the target portion having spatial characteristics relative to the substrate support that are appropriate for a desired exposure patterned on the surface of the substrate supported in a predetermined position on the substrate support~~;

measuring a respective temperature of a plurality of regions of the substrate;

calculating a dimensional response of the substrate relative to the respective measured temperature; and

adjusting the spatial characteristics of the patterned beam~~target portion~~ relative to a~~the~~ substrate support to compensate for the calculated dimensional response.

14. (currently amended) The method according to claim 13, wherein the temperature is measured at [[a]]the plurality of regions distributed across the surface of the substrate.

15. (original) The method according to claim 13, wherein the temperature is measured with a plurality of sensors distributed across the substrate support and each of the plurality of sensors sense the temperature of an adjacent region of the substrate.

16. (original) The method according to claim 15, wherein:

the plurality of sensors are distributed on a sensor support located above the substrate support;

the substrate support and the plurality of sensors are displaced relative to each other; and

the temperature of regions of the substrate adjacent each of the plurality of sensors are measured at each of a plurality of relative positions between the substrate support and the sensor support.

17. (original) The method according to claim 16, wherein the plurality of sensors are supported on a stationary frame located above the substrate support and the substrate support is displaced beneath the frame.

18. (original) The method according to claim 17, wherein the substrate support is displaced in a predetermined direction and the sensors are supported in a linear array extending transverse to the said direction.

19. (currently amended) The~~A~~ method according to claim 13, further comprising~~wherein~~:

generating a map of the temperature across the substrate ~~is developed~~;

developing a model of the dimensional response of the substrate in a substrate-support coordinate system ~~is developed~~;

generating a substrate position map ~~is developed, which~~ that represents a change in position of points on the substrate relative to the substrate support coordinate system given the map of the temperature across the substrate and the model of the dimensional response; and

adjusting the spatial characteristics of the patterned beam~~target portion are adjusted~~ in accordance with the substrate position map to compensate for the dimensional response.

20. (currently amended) The method according to claim 13, wherein the spatial characteristics are adjusted by adjusting a shape of the patterned beam~~target portion~~.

21. (currently amended) The method according to claim 13, wherein the spatial characteristics are adjusted by adjusting a position of the patterned beam~~target portion~~ relative to the substrate support.

22. (currently amended) The[[A]] method according to claim 13, wherein the spatial characteristics are adjusted by adjusting a size of the patterned beam~~target portion~~.

23. (currently amended) A method ~~for establishing a model of a dimensional response of a substrate to changes in temperature, the method~~ comprising:

~~forming a plurality of alignment features on a surface of the substrate;~~

~~distributing the alignment features across the surface of the substrate, such that their spatial distribution is predetermined assuming a predetermined substrate temperature;~~

measuring ~~a~~ temperatures of a plurality of regions of a ~~the~~ substrate having a plurality of alignment features on a surface of the substrate;

measuring a spatial distribution of the alignment features at a first region at the measured substrate temperature; and

determining a ~~deriving a model of the~~ dimensional response from differences between ~~the~~ a predetermined spatial distribution and the measured spatial distribution.

24. (original) The method according to claim 23, wherein:

the substrate is a reference substrate which is one of a class of substrates having similar physical characteristics and which are to be processed in a lithographic apparatus;

the spatial distribution of the alignment features of the reference substrate is measured when the reference substrate is supported on a substrate support of the lithographic apparatus;

a member of the class of substrates is subsequently placed on the substrate support;

the temperature of the substrate supported on the substrate support is measured at each of a plurality of regions distributed across a substrate surface; and

processing of the substrate is adjusted based on correlating a change in the substrate dimensions with a dimensional response model derived from the reference substrate.

25. (original) The method according to claim 23, wherein:

the predetermined spatial distribution is determined by measuring the temperature of the substrate and a concurrent distribution of the alignment features during a first measurement step; and

the measured spatial distribution is determined by measuring the temperature of the substrate and a concurrent distribution of the alignment features during a second measurement step.

26. (original) The method according to claim 23, further comprising:

forming a first pattern of alignment features when the substrate is at a first temperature;

forming a second pattern of alignment features when the substrate is at a second temperature; and

deriving the dimensional response model from differences between measurements of the first and second patterns and differences between the first and second temperatures.

27. (original) The method according to claim 26, wherein:

causing the first and second patterns to have a same nominal spatial distribution with a nominal offset between the two patterns; and

deriving the dimensional response model from differences between nominal and measured offsets between features of the two patterns.

28. (original) The method according to claim 26, wherein

forming the first pattern on a reference substrate that is one of a class of substrates having similar physical characteristics and which are to be processed in a lithographic apparatus;

forming the second pattern on the reference substrate by exposing a layer of resist supported on the reference substrate in the lithographic apparatus;

measuring the differences between the nominal and measured offsets within the lithographic apparatus; and

washing the exposed resist off the reference substrate to enable re-use of the reference substrate.